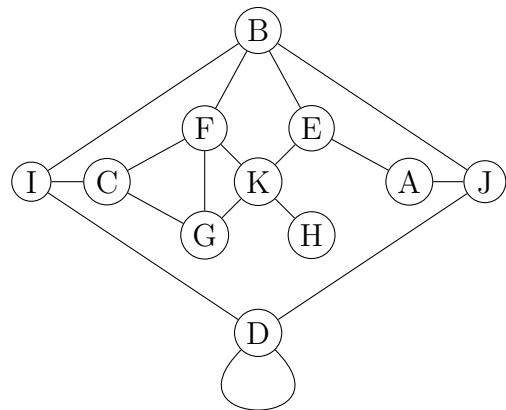
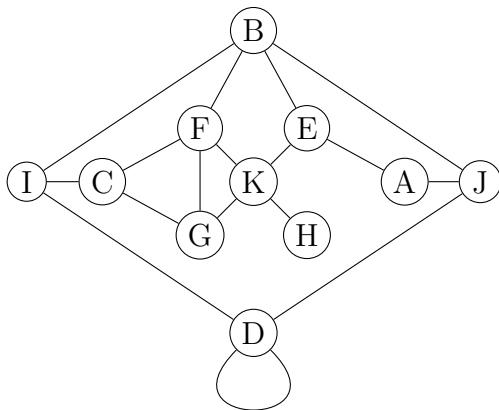


Worksheet 9 (Graph Theory 1): Pieces of Graphs

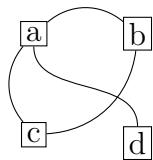
1. Graph Q is shown below (twice). Answer the questions:



- (a) How many vertices does graph **Q** have? _____
 - (b) How many edges does graph **Q** have? _____
 - (c) Degree of vertex *A*? _____
 - (d) Degree of vertex *H*? _____
 - (e) Degree of vertex *D*? (remember, loops count twice) _____
 - (f) Label each vertex on the right-hand copy of the graph with its degree.
 - (g) Which vertex/vertices has/have the largest degree? _____
 - (h) Find a path from *K* to *D*. Draw it on the (left-hand) graph. How many edges does your path have? _____
 - (i) What is the length of the shortest path from *I* to *J*? _____ Write the path here: _____
 - (j) Find a circuit in the graph and highlight it on the graph. Write the circuit here:

 - (k) Find a path that visits every vertex exactly once. Highlight it on the right-hand copy of the graph.
 - (l) Explain why you can't find a circuit that passes through every vertex of the graph.

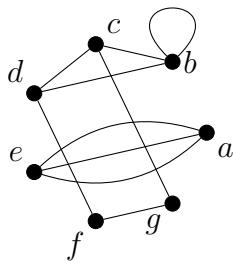
2. Here's a small graph, Graph **T**. To the right, represent it as a table (technically, as an "adjacency matrix"), by writing **1** in the spot in the row/column intersection if there's an edge between the row-vertex and column-vertex and **0** otherwise. For example, since there is an edge from vertex **a** to vertex **d**, we put a **1** in the first row, fourth column.



	a	b	c	d
a				1
b				
c				
d				

Find a circuit in the graph. List the vertices in the circuit: _____

3. Here's another graph, Graph **R**.



- (a) Explain why this graph is not connected.
- (b) A *connected component* is a piece of a graph that *is* connected. To the right of the graph, draw the two connected components of graph R separately, with no crossing edges. (You will need to change the position of the vertices and edges!)
- (c) Label each vertex with its degree.
- (d) How many edges does graph R have? _____
4. Using our previous graphs, fill in the following table:

Graph	sum of the degrees	number of edges
Graph Q		
Graph T		
Graph R		

Fill in the blank: The sum of all the degrees of the vertices of a graph is _____ the number of edges of the graph.